Development of a Method Towards the Metabolic Monitoring of TCA Cycle Compounds Observed in Rat Urine Using NMR Spectroscopy

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Development of a Method Towards the Metabolic Monitoring of TCA Cycle Compounds Observed in Rat Urine Using NMR Spectroscopy Sai Sumedha Bobba James Clemens High School, Madison, Alabama, United States of America Metabolomics is the comprehensive identification and quantitation of small molecule intermediates and products of cellular metabolic processes. It can provide new insight into biological states and drug interactions to progress understanding and treatment of various diseases. Type 1 diabetes (T1D) is an autoimmune disease in which insulin-producing beta cells are destroyed by the affected individual's immune system. Although T1D can be treated with insulin therapy, there is little known regarding the effects of T1D on cellular respiration, specifically the tricarboxylic acid (TCA) cycle. This experiment was aimed towards developing a method for the quantitation of TCA cycle intermediates in urine samples from T1D-prone rats using nuclear magnetic resonance (NMR) spectroscopy. Rats have a metabolism that is like that of humans, so they can be used as a representative model. The results of this project show that quantitation of the TCA cycle compounds through NMR spectroscopy is possible; however, the compounds' NMR peak positions must be specifically located for the urine samples to ensure accurate quantitation. Peak ranges from pure compound solutions and general ranges from the Human Metabolome Database cannot easily be used due to the varying chemical environments of the urine samples and their effects on the spectra. Citric acid was the only intermediate from the TCA cycle observed in the urine collected premortem and was effectively quantified using the developed method.

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